

Gen II EV1 Battery Choice

- Delco Advanced PbA vs. Panasonic PbA
 - GM's use of its own Delco batteries had resulted in very high service costs due to frequently need for replacement
 - With Panasonic, **range increased 50%** and now met the vehicle specifications (70-90 miles), and reliability was greatly enhanced
 - Unclear whether battery difference was due to relaxation in specifications, or ??
 - **Substitution with Panasonic batteries was very successful**

2000: Battery Panel Review

- **Nickel metal hydride**
 - **Demonstrated good characteristics and reliability with life expectancy exceeding 6 years**
 - **Real-life range of full size EV limited to 70-100 miles**
 - **Price in volume production estimated at \$9,000 per pack**

2000: Battery Panel Review

- **Lithium ion batteries**
 - **Did not yet have adequate durability**
 - **Safety not fully proven**
 - **In mass production, cost unlikely to drop below nickel metal hydride without major advances in:**
 - **materials**
 - **manufacturing**

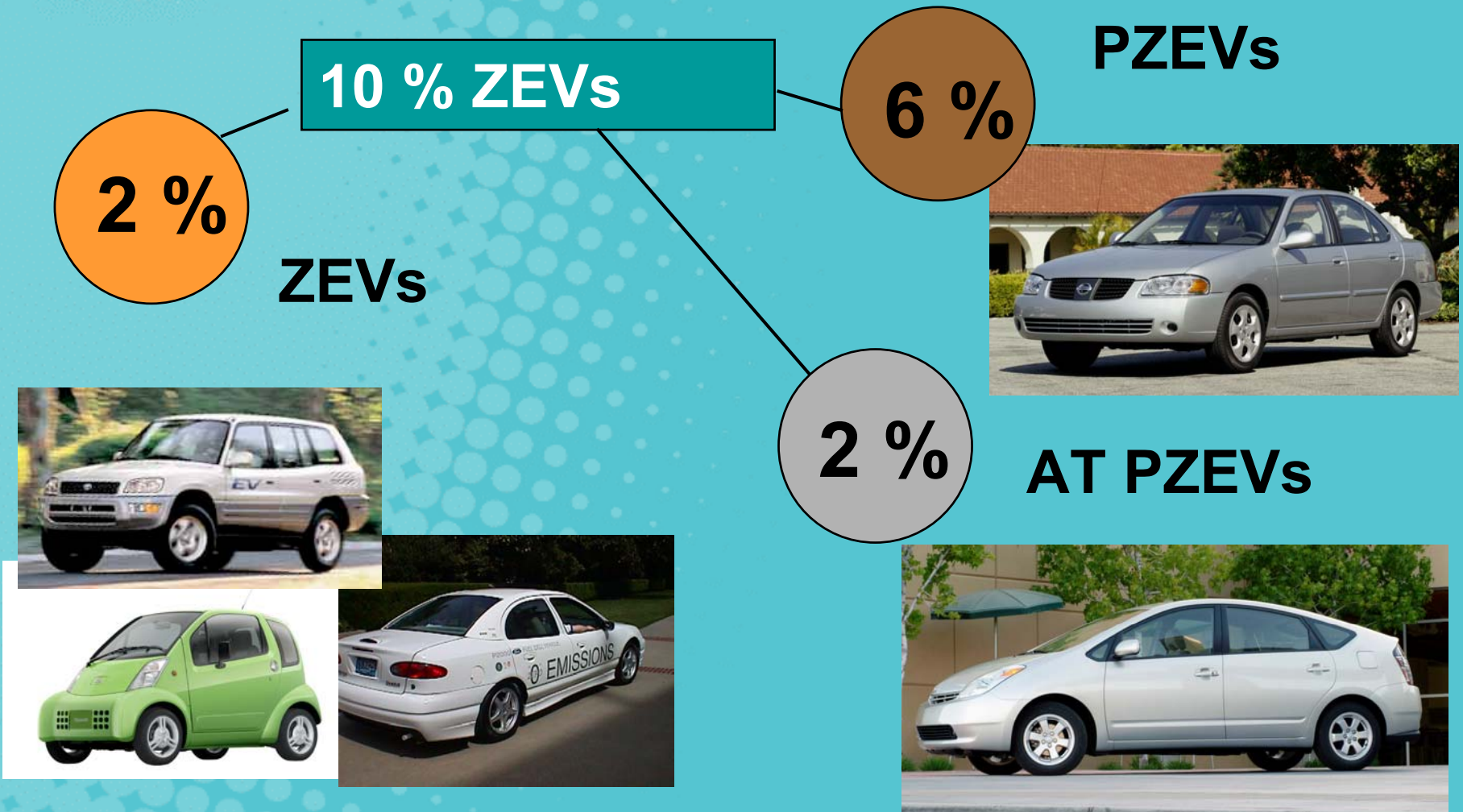
September 2000: Air Resources Board Meeting

- Reaffirmed commitment to the ZEV requirements
- Directed staff to address:
 - Cost
 - Near-term vehicle availability
 - Market stability
 - Public education

2001: ZEV Amendments

- **Maintained core technology-forcing mandate**
- **Phased in ZEV and PZEV requirements**
- **Allowed further ZEV reduction if offset with Advanced Technology PZEVs (AT-PZEVs)**
- **Segregated NEVs and assigned them fractional ZEV credit**
- **Gradually increased future ZEV requirements**

2001 ZEV Regulation



2001: Advanced Technologies Encouraged with AT-PZEVs

- **Technologies that potentially lead to ZEVs**
 - **Electric drive**
 - **ZEV Energy Storage**
 - **Hydrogen**
 - **High pressure tanks**
 - **Hydride storage**
 - **???**
 - **Batteries**
 - **Ultracapacators**

2001: ZEV Litigation

- **Federal preemption lawsuit**
 - **Preliminary injunction issued June 2002, prohibiting ARB from enforcing the regulation in 2003 or 2004 model years**
- **First state court lawsuit**
- **Second state court lawsuit**
- **Settlement agreement for all cases signed August 2003**

2002: FreedomCAR

- Announced in January 2002
- Cooperative research effort (composed of Ford, GM and DaimlerChrysler)
- Aim at longer term goals - **Hydrogen Fuel Cells** - with some effort on nearer term technologies that offer early opportunities to save petroleum
- Goal is to develop cars and trucks that are:
 - cheaper to operate,
 - **pollution free**,
 - competitively priced, &
 - free from imported oil



Transition to Future Technologies

- **ATPZEV Option**
 - introduces new ZEV technologies
 - encourages further development
 - volume production reduces costs
- **Prototype fuel cell vehicles now being demonstrated**
 - California Fuel Cell Partnership
- **BEVs still likely in urban applications**